

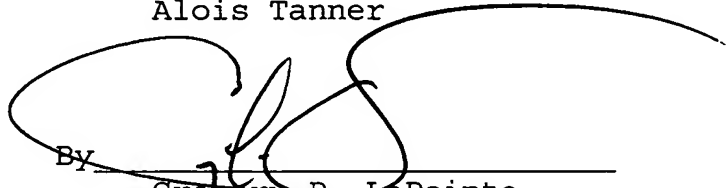
REMARKS/ARGUMENTS

A substitute specification is being filed in order to conform with U.S. practice. Headings have been added to the specification. Spelling and grammatical errors have also been corrected. The substitute specification contains no new matter. Amendments have been made to the claims to remove the multiple dependencies and an abstract has been added. An early action on the merits is respectfully requested.

If any additional fees are required in connection with this case, it is respectfully requested that they be charged to Deposit Account No. 02-0184.

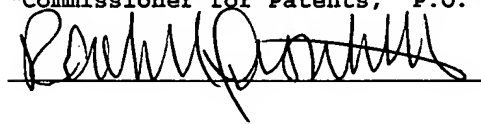
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Date: May 19, 2006

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SUBSTITUTE SPECIFICATION WITH MARKINGS

WO-2005/049426

**Banding of stacked goods to be packaged**BACKGROUND OF THE INVENTION

[0001] The invention relates to a method for banding stacked, soft and/or sensitive goods to be packaged, with a banding machine, wherein the unwound package band is guided around the goods to be packaged, pulled onto the goods to be packaged in a reverse movement, glued or welded and cut off.

[0002] In banding machines, a band-shaped sheet made of paper, plastics material or a composite is guided in a band guide limiting the extension, around the stack of goods to be packaged, as a loop. This band guide is configured as an open or closed arc, depending on the stiffness of the package bands, the dimensions and the use. In the case of soft package bands, numerous means for holding up the band during and after passage through the arc are known; however, a free reverse movement for tightening the band has to be ensured.

[0003] Basically, the goods to be packaged and to be banded can be configured in any manner, for example square, rectangular, round or trapezoidal with regard to area. At least one package band is positioned, simultaneously or successively in the case of several.

[0004] A banding machine which operates fully automatically firstly forms a loop which is intrinsically stable or held up, into which the stack of goods to be packaged is placed. The stack of goods to be packaged can also be inserted prior to formation of the loop. Controlled by a sensor or triggered by a hand or foot switch, the package band, which is clamped at its free end, is drawn back, until it rests snugly on the goods to be packaged. The clamped end is then glued or welded to the

tightened band and cut off. Soft and/or sensitive stacks can be more or less compressed by hand before the reverse movement of the package band.

[0005] The basic principle of banding is widely known. In EP 0551244 A1, a banding machine is described, which comprises cold welding. This ensures a clean closure, requires less maintenance, prevents deposits of sheet burning and the replacement of heating elements.

[0006] US 5146847 relates to a device and a method for banding articles. The length of the package band which is guided around the articles is continuously monitored by way of the band drive roller and a corresponding signal is emitted. The drive motor shoots the package band at a first predetermined speed into the band guide, the signal for the measured length being compared with a first entered length. On reaching this length, the speed of the drive motor is reduced to a second predetermined speed, the length of the package band which has been shot in is compared with a second predetermined length and, on reaching this, the reverse movement is initiated.

[0007] Despite far advanced automation and refinement of the individual components, banding of soft and/or sensitive goods to be packaged remains a problem that until now could only be satisfactorily solved to a certain extent. It is not the initiation, but the ending of the reverse movement which is important in this regard.

[0008] The present invention is based on the object of providing a method of the type mentioned at the outset, in which the banding of soft and/or sensitive goods to be packaged can be completely automated. The banded goods to be packaged should be neither deformed to an undesired extent nor damaged.

SUMMARY OF THE INVENTION

[0009] According to the invention, the object is achieved in that a preselection loop of the package band is pulled back to a preselected loop length in the reverse movement with the aid of an electronic control system. Special and developing embodiments of the method are the subject of dependent claims.

[0010] With the method according to the invention, control of the reverse movement for tightening the package band around the stacked goods to be packaged is put on a new footing. The preselected control variable for controlling the working process is no longer the band tension, but a preselected loop length. It can thus be established in advance how long a loop placed around the stacked soft and/or sensitive goods to be packaged should be. The control is advantageously improved thereby; in these stacks of goods to be packaged even a slight change in a predetermined band tension can have undesired consequences, which can be prevented with a preselected loop length.

[0011] The reverse movement of the package band is preferably ended by a precisely co-running rotary encoder roller, which is electronically activated by the control system, in particular digital control system. In other words, the rotary encoder roller, on reaching the predetermined loop length, triggers an electric signal, whereupon the control system initiates an immediate stopping of the reverse movement by way of a band drive roller.

[0012] Prior to the beginning of the process, the stacked goods to be packaged can be measured manually and the corresponding data entered into the control system, where it is selectably stored. According to an advantageous development, the stacked goods to be packaged are automatically measured at the beginning of the process; the data is entered into the digital control system and selectably stored.

[0013] If it is established during the banding process that the predetermined loop length is not optimum, a value correction can be entered and also selectably stored.

[0014] The electronic control system, preferably a digital control system, is expediently programmed in such a way that if the preselected loop length is not reached, the process is interrupted and a fault is indicated. The risk of undesired deformation of soft products and/or damage to sensitive products is thus largely ruled out. Furthermore, a stack with an excess piece can be identified.

[0015] As an additional measure to the preselected loop length, a maximum band tension that can be selected by the control system, again preferably a digital control system, can be entered for the reverse movement of the package band. Obviously, this value is also product-specific and can be entered or stored. On exceeding the predetermined maximum band position, the process is also interrupted and a fault is indicated. A suitable solution can be found even for the most sensitive products by this double measure.

[0016] Furthermore, to end the reverse movement of the package band, in addition to the preselected loop length, a minimum band tension, which can be selected by the control system, can be entered. In the event of a repeated successive falling below the minimum band tension, a programme-controlled shortening of the loop length may take place. With this further developed method, the package band can be prevented from not fitting closely enough in the case of soft and/or sensitive stacked goods. So that no arbitrary correction takes place, a repeated successive falling below is programmed, for example three or six times. Obviously, the elimination of a band tension which is too low on ending the reverse movement can also be entered and stored manually. According to a variant, when

the predetermined minimum band tension is fallen below, the process can be interrupted and a fault indicated. Thus a stack of goods to be packaged with a missing piece can be indicated.

[0017] The present method according to the invention does not intrinsically need any printer's imprint's *per se*. In the case of a printed package band, the method according to the invention can be supplemented, however, by a special printer's imprint control system, which places the imprint so that it can be precisely repeated, for which purpose methods known *per se* are used.

[0018] Combined banding machines can print the sheet bands passing through simultaneously. For this purpose, the printed-on information are also positioned in a controlled manner with the aid of the preselection loop and preferably banded centrally.

[0019] A method for a fully automated banding of soft and/or sensitive products has been provided by the present invention and can meet the highest requirements and nevertheless operate economically.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0020] The invention will be described in more detail with the aid of embodiments shown in the drawings, which are also the subject of dependent claims. In the drawings, schematically:

[0021] Fig. 1 shows a view of a banding machine with a rotary encoder roller,

[0022] Fig. 2 shows a working table of a banding machine with an arcuate band guide and the inserted stacked goods to be packaged,

[0023] Fig. 3 shows the reverse movement of a package band, and

[0024] Fig. 4 shows a package band placed around the stacked goods to be packaged.

#### DETAILED DESCRIPTION

[0025] Fig. 1 shows a banding machine 10 with a height-adjustable chassis 12 on lockable wheels 14. A concealed unwinding disc 18 with a banding roller 20 is rotatably mounted on a transverse strut 16 of the chassis 12. A package band 22 is unwound by way of a band store 24, which comprises three stationary deflection pulleys 26 and three deflection pulleys 30 mounted on a tensioned, pivotable lever 28. The band store 24 is used as a reserve during the very rapid loop formation.

[0026] Downstream from the band store 24, the package band 22 is drawn into a band channel 32, which is arranged in a machine housing 34 with a folding table plate 36. Further concealed machine elements are arranged in this machine housing 34, in particular a band drive roller 38, a transport roller 42 that presses the package band 22 onto the band drive roller 38 with a corresponding position of a lever 40, or allows it to run freely, a rotary encoder 44 which co-runs precisely with the package band 22, a holding-down plate 46, a welding and cutting unit 48, and a control system 60, in the present case a digital control system, that is electrically connected to the drive of the band drive roller 38 and the rotary encoder 44.

[0027] The band guide 50 in the region of the stacked goods to be packaged 52, in the present case, is open, owing to two plane-symmetrically arranged support clamps 54, which are easily supported by a horizontal channel which is open at the bottom.

[0028] Arranged below a flap cover 58 is a switch 56, which simultaneously indicates the band end. The switch 56 can also be configured as a foot switch. Actuation of the switch 58 activates the band drive roller 38, which thrusts the package

band 22 at great speed through the band guide 50. After formation of an arc, which is uncovered at the top in the present case, the front end of the package band 22 is clamped. The band drive roller 28 rotates in the opposite direction and tightens the package band 22 around the inserted, stacked goods to be packaged 52, which is called a reverse movement. An exact loop length  $L$  is specified to the rotary encoder roller 44, which length is monitored by it with the aid of the digital control system 60. On reaching the predetermined length  $L$ , the digital control system 60 immediately stops the reverse movement. The welding and cutting unit 48 then goes into action.

[0029] The three essential phases of the method according to the invention are shown again, briefly schematised, in Figs. 2 to 4.

[0030] Fig. 2 shows a stack of goods to be packaged 52, which, lying on the folding table plate 36, is positioned in the band guide 50 in such a way that banding is carried out at the desired location.

[0031] Fig. 3 shows a phase of the reverse movement of the package band 22 in the direction of the arrow 62 to the loop length  $L$  predetermined by the digital control system 60 and measured by the rotary encoder roller 34 (Fig. 1).

[0032] Fig. 4 shows the finished banded stack of goods 52 to be packaged. The package band 22 with the length  $L$  lies in a serpentine manner on the stack of goods to be packaged 52, but without deforming or otherwise damaging the soft individual elements.